

Appl. No. : 10/657,416
Filed : September 8, 2003

AMENDMENTS TO THE CLAIMS

Please amend the Claim Form and Claim as follows. Insertions are shown underlined while deletions are ~~struck through~~. Please add Claim 22.

1 (currently amended): A method for forming an interlayer insulation film for multilayer interconnect of a semiconductor integrated circuit, comprising the steps of:

forming a first insulation film on a substrate in a reactor by plasma CVD using a first source gas comprising a silicon-containing hydrocarbon gas;

continuously forming a second insulation film on the first insulation film in the same reactor at a thickness less than the first insulation film *in situ* by plasma CVD using a second source gas comprising a silicon-containing hydrocarbon gas and an oxidizing gas under a pressure of 3 Torr or less which is lower than a pressure used for the formation of the first insulation film; and

subjecting the second insulation film to polishing for forming a subsequent layer thereon.

2 (previously presented): A method for forming an interlayer insulation film for multilayer interconnect of a semiconductor integrated circuit, comprising the steps of:

forming a first insulation film on a substrate by plasma CVD using a first source gas comprising a silicon-containing hydrocarbon gas;

continuously forming a second insulation film on the first insulation film at a thickness less than the first insulation film *in situ* by plasma CVD using a second source gas comprising a silicon-containing hydrocarbon gas and an oxidizing gas; and

subjecting the second insulation film to polishing for forming a subsequent layer thereon,

wherein the first insulation film has a hardness of less than 6 GPa, and the second insulation film has a hardness of no less than 6 GPa.

3 (currently amended): ~~A~~The method according to Claim 2, ~~for forming an interlayer insulation film for multilayer interconnect of a semiconductor integrated circuit, comprising the steps of:~~

~~forming a first insulation film on a substrate by plasma CVD using a first source gas comprising a silicon-containing hydrocarbon gas;~~

~~continuously forming a second insulation film on the first insulation film at a thickness less than the first insulation film *in situ* by plasma CVD using a second source gas comprising a silicon-containing hydrocarbon gas and an oxidizing gas; and~~

~~subjecting the second insulation film to polishing for forming a subsequent layer thereon;~~

wherein the first source gas further comprises an oxidizing gas having a flow rate which is less than 1.0 times that of the silicon-containing hydrocarbon gas.

4 (currently amended): ~~A~~The method according to Claim 2, for forming an interlayer insulation film for multilayer interconnect of a semiconductor integrated circuit, comprising the steps of:

~~forming a first insulation film on a substrate by plasma CVD using a first source gas comprising a silicon-containing hydrocarbon gas;~~

~~continuously forming a second insulation film on the first insulation film at a thickness less than the first insulation film *in situ* by plasma CVD using a second source gas comprising a silicon-containing hydrocarbon gas and an oxidizing gas; and~~

~~subjecting the second insulation film to polishing for forming a subsequent layer thereon;~~

wherein the oxidizing gas in the second source gas has a flow rate which is more than 1.0 times that of the silicon-containing hydrocarbon gas in the second source gas.

5 (original): The method as claimed in Claim 4, wherein the second insulation film is formed under conditions where RF power is reduced and the flow rate of the silicon-containing hydrocarbon is reduced, as compared with those for the first insulation film.

6 (currently amended): ~~A~~The method according to Claim 2, for forming an interlayer insulation film for multilayer interconnect of a semiconductor integrated circuit, comprising the steps of:

~~forming a first insulation film on a substrate by plasma CVD using a first source gas comprising a silicon-containing hydrocarbon gas;~~

~~continuously forming a second insulation film on the first insulation film at a thickness less than the first insulation film *in situ* by plasma CVD using a second source gas comprising a silicon-containing hydrocarbon gas and an oxidizing gas; and~~

~~subjecting the second insulation film to polishing for forming a subsequent layer thereon;~~

wherein the silicon-containing hydrocarbon in the second source gas has the formula $\text{Si}_\alpha\text{O}_{\alpha-1}\text{R}_{2\alpha-\beta+2}(\text{OC}_n\text{H}_{2n+1})_\beta$ where α is an integer of 1-3, β is an integer of 0-2, n is an integer of 1-3, and R is C_{1-6} hydrocarbon attached to Si.

7 (currently amended): The method as claimed in Claim 6, wherein the silicon-containing hydrocarbon in the second source gas is dimethy-dimethoxysilane.

8 (currently amended): The method as claimed in Claim 3, wherein the oxidizing gas in the first source gas is at least one selected from the group consisting of oxygen, dinitrogenoxide, ozone, hydrogen peroxide, carbon dioxide, and polyalcohol.

9 (previously presented): The method as claimed in Claim 3, wherein the silicon-containing hydrocarbon gas in the first source gas and the silicon-containing hydrocarbon gas in the second source gas are the same gas.

10 (previously presented): The method according to Claim 2, wherein the first source gas comprises no oxidizing gas.

11 (currently amended): ~~A~~The method according to Claim 2, for forming an interlayer insulation film for multilayer interconnect of a semiconductor integrated circuit, comprising the steps of:

~~forming a first insulation film on a substrate by plasma CVD using a first source gas comprising a silicon-containing hydrocarbon gas;~~

~~continuously forming a second insulation film on the first insulation film at a thickness less than the first insulation film *in situ* by plasma CVD using a second source gas comprising a silicon-containing hydrocarbon gas and an oxidizing gas; and~~

~~subjecting the second insulation film to polishing for forming a subsequent layer thereon;~~

wherein the second insulation film is composed of multiple layers having different oxygen contents.

12 (currently amended): ~~A~~The method according to Claim 2, for forming an interlayer insulation film for multilayer interconnect of a semiconductor integrated circuit, comprising the steps of:

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~~forming a first insulation film on a substrate by plasma CVD using a first source gas comprising a silicon-containing hydrocarbon gas;~~

~~continuously forming a second insulation film on the first insulation film at a thickness less than the first insulation film *in situ* by plasma CVD using a second source gas comprising a silicon-containing hydrocarbon gas and an oxidizing gas; and~~

~~subjecting the second insulation film to polishing for forming a subsequent layer thereon;~~

~~said method further comprising forming via holes and/or trenches in the first and second insulation films, and filling the holes and/or trenches with copper for interconnect, wherein the said polishing conducted thereafter is chemical mechanical polishing (CMP) and is conducted after the filling of the holes and/or trenches with copper.~~

13-21 (canceled)

22 (new): The method according to Claim 1, wherein the pressure for forming the second insulating film is 1 Torr or less.